Fertilizers Recommendation System for Disease Prediction

PROJECT REPORT

Submitted by

Team ID: PNT2022TMID36162

B. ISHAARRTHY (110519104005)

M. KARTHIGA (110519104012)

S. SNEGHA (110519104025)

K. PREETHI (110519104018)

In partial fulfilment for the award of the degree
of

BACHELOR OF ENGINEERING

In

COMPUTER SCIENCE AND ENGINEERING

GOJAN SCHOOL OF BUSINESS AND TECHNOLOGY

NOV-2022

INDEX

1. INTRODUCTION:

1.1 Project overview:

Agriculture is the most important sector in today's life. Most plants are affected by a wide variety of bacterial and fungal diseases. Diseases on plants placed a major constraint on the production and a major threat to food security. Hence, early and accurate identification of plant diseases is essential to ensure high quantity and best quality. In recent years, the number of diseases on plants and the degree of harm caused has increased due to the variation in pathogen varieties, changes in cultivation methods, and inadequate plant protection techniques.

An automated system is introduced to identify different diseases on plants by checking the symptoms shown on the leaves of the plant. Deep learning techniques are used to identify the diseases and suggest the precautions that can be taken for those diseases.

1.2 Purpose:

1. Preprocess the images.

2. Applying the CNN algorithm to the dataset.

3. How deep neural networks detect the disease.

4. You will be able to know how to find the accuracy of the model.

5. You will be able to build web applications using the Flask framework.

2. LITERATURE SURVEY:

2.1 Existing problem:

A digital camera or similar devices are used to take images of different types, and then those are used to identify the affected area in leaves. Then different types of image-processing techniques are applied to them, the process those images, to get different and useful features needed for the purpose of analyzing later-Plant leaf disease identification is especially needed to predict both the quality and quantity of the First segmentation step primarily based on a mild polygonal leaf model is first achieved and later used to guide the evolution of an energetic contour. Combining global shape descriptors given by the polygonal model with local curvature-based features, the leaves are then classified over leaf datasets.

2.2 References:

[1] Reyes Angie .K, Juan C. Caicedo, and Jorge E. Camargo, "Fine-tuning Deep Convolutional Networks for Plant Recognition", In CLEF (Working Notes), 2015

[2] Hamrouni .L, Aiadi .O, Khaldi .B and Kherfi .M.L, "Plants Species Identification using Computer Vision Techniques", Revue des Bioressources 7, no. 1, 2018.

[3] Dimitrovski, Ivica, GjorgjiMadjarov, DragiKocev, and PetreLameski, "Maestra at LifeCLEF 2014 Plant Task: Plant Identification using Visual Data", In CLEF (Working Notes), pp. 705

[4] Naresh, Y. G., and H. S. Nagendraswamy, "Classification of medicinal plants: an approach using modified LBP with symbolic representation", Neurocomputing 173, pp: 1789-1797, 2016.

[5] Sue Han, CheeSeng Chan, Paul Wilkin, and Paolo Remagnino, "Deep-plant: Plant identification with convolutional neural networks", In Image Processing.

.

2.3 Problem statement definition:

Customer problem statement template:

Create a problem statement to understand your customer's point of view. The Customer Problem Statement template helps you focus on what matters to create experiences people will love. A well-articulated customer problem statement allows you and your team to find the ideal solution for the challenges your customers face. Throughout the process, you'll also be able to empathize with your customers, which helps you better understand how they perceive your product or service.

3. IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes. It is a useful tool to helps teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.
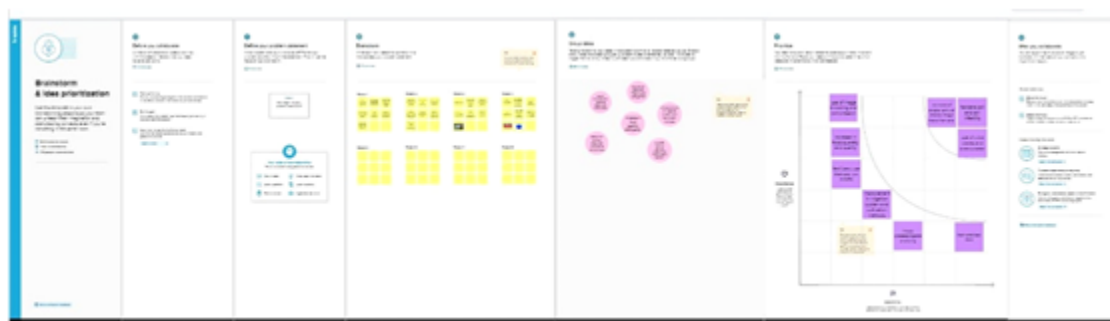
3.2 Ideation &Brainstorming:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions. Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

Step-1: Team Gathering, Collaboration and Select the Problem Statement

Step-2: Brainstorm, Idea Listing and Grouping

Step-3: Idea Prioritization

3.3 Proposed Solution:

S. No	Parameter	Description
1	Problem Statement (Problem tobe solved)	Most plants are affected by a wide variety of bacterial and fungal diseases. Diseases on plants placed a major constraint on the production and a major threat to food security. To find what diseases that the plat is having by its leaf
2	Idea / Solution description	An automated system is introduced to identify different diseases on plants by checking the symptoms shown on the leaves of the plant. Deep learning techniques are used to identify the diseases and suggest the precautions that can be taken for those diseases
3	Novelty / Uniqueness	It has UI (user interface) which makes communication between human and machine easy & DL (deep learning) which makes computer vision on image processing easier and pattern recognition to understand which disease is affected to the plant.
4	Social Impact / Customer Satisfaction	It help the customer to know what fertilizer has to be given in the fields as soon the disease is affected to the plants. Makes the food productivity large
5	Business Model (Revenue Model)	The business model is hinged on a multiple revenue stream approach which results in three value propositions: a) provision 6of sustainable b) increased supply of environmentally-friendly fertilizer c) provision of recyclables. Strategies to be considered a) partnership; b) market segmentation; c) production innovation.
6	Scalability of the Solution	The solution given increases the food productivity that is increases in quantity and decrease the food scarcity

3.4 Problem solution fit:

Problem-Solution fit canvas 2.0 — Purpose / Vision

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) — CS

A farmer who has field which is attacked by the pathogens or variety of fungal disease

6. CUSTOMER CONSTRAINTS — CC

Type of soil,access to water resources ,acess to machine in lands (like tractor,tiller) investment and credit,distance to market

5. AVAILABLE SOLUTIONS — AS

An automated system is introduced to identify different diseases on plants by checking the symptoms shown on the leaves of the plant .pro's immediate identification of fertilizer to be used.

Explore A.S, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS — J&P

To reduce the fungal and bacterial diseases affected plants early and accurate identification of plant diseases ,harm caused to the plants due to inadequate irrigation process and cultivation methods.

9. PROBLEM ROOT CAUSE — RC

Insufficient water supply and cultivation methods are the real reason for the problem. This job is done due to food scancity and harms caused to the plants by the bacteria's &fungal diseases and insufficient minerals in the soil .the farmer wants to increase his production and get income in return to the amount he has spent in the fields.

7. BEHAVIOUR — BE

directly related:find the right fertilizer to be used ,calculate the amount of usage ,and the results in production indirectly associated: customer spend more time in selling and handling the cattle's.

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS — TR

by seeing the neighbour having good production, more efficiency news by fertilizer shop owners .

4. EMOTIONS: BEFORE / AFTER — EM

Before: lost and less amount of production in the fields loss of confidence,loss of cost
After: gain in the quantity and quality, gets in control,

10. YOUR SOLUTION — SL

An automated system is introduced to identify different diseases on plants by checking the symptoms shown on the leaves of the plant. Deep learning techniques are used to identify the diseases and suggest the precautions that can be taken for those diseases.

8. CHANNELS of BEHAVIOUR — CH

8.1 ONLINE
he sends the picture of the affected plant through internet , calculate the amount of usage.

8.2 OFFLINE
the customer uses the recommended fertilizer according to the amount of land he have , less amount of fertilizer less cost.

Extract online & offline CH of BE

★ AMALTAMA

4. REQUIREMENT ANALYSIS:

4.1 Functional requirement:

Following are the functional requirements of the proposed solution.

FR no.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIn
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Website comparison	Model compares the fertilizer using blacklist and whitelist approach
FR-4	Prediction	Model predicts the URL using Deep learning algorithm Such CNN,
FR-5	Classifier	Model send all output to classifier and produces final results.
FR-6	Events	This model needs the capability of retrieving and displaying accurate result of the fertilizer.

4.2 Non-Functional requirements:

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The customer has full access on the system and on the data and images through image processing.
NFR-2	Security	The images used in the images processing as a dataset is backed up.
NFR-3	Reliability	The system should be user friendly to the customer while using the system.
NFR-4	Performance	The accuracy of the prediction must be high.
NFR-5	Availability	The resources should be always available for the system when then user in need.
NFR-6	Scalability	It must be able to handle larger data without any interruption or damage to the system.

5. PROJECT DESIGN:

5.1 Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enter and leaves the system, what changes the information, and where data is stored.
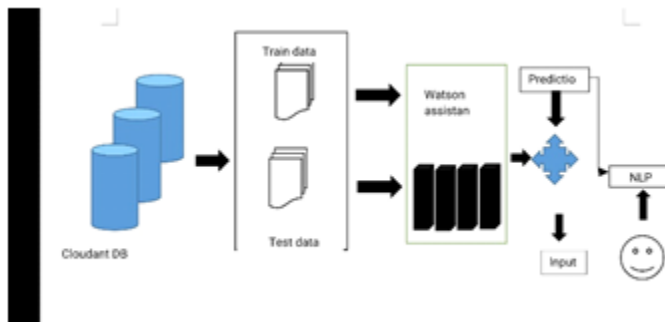
level0 dfd diagram
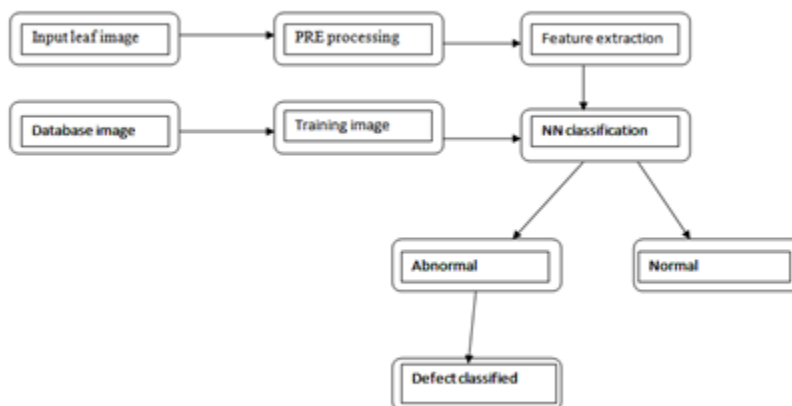
5.2 Solution & Technical architecture:

●Deep learning techniques are used to identity diseases, through image processing.

●The customers gives in the image, the user interface accepts   the image and goes inside the DL algorithm

●First its train the data and test the image data and then gives the output
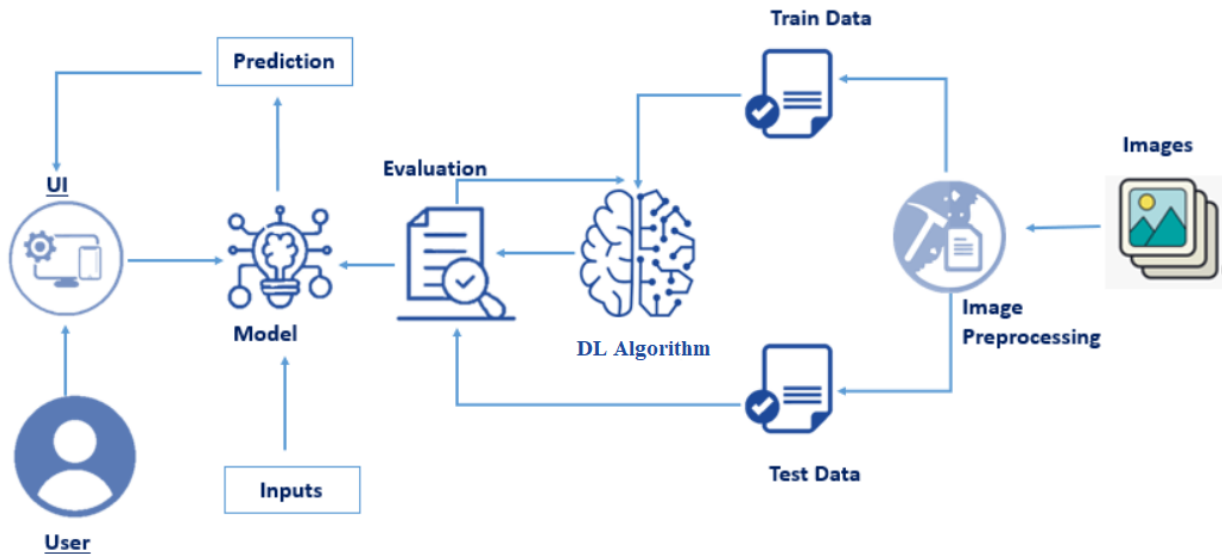
5.3 USER STORIES:

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail		Medium	Sprint-1

	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard		As a user u can see the improvement as a graph		Medium	Sprint-2
Customer (Web user)	User input		The input is given as a image or a dataset		Medium	Sprint-1
Customer Care Executive	Feature extraction		The process of transforming raw data into numerical features that can be processed while preserving the information in the original data set.		High	Sprint-1

Administrator	prediction		Leaves are affected by bacteria, fungi, virus, and other insects. Support Vector Machine (SVM) algorithm classifies the leaf image as normal or affected		Low	Sprint-2
	classifier		Artificial neural network is used to assign a class label to data input		Medium	Sprint-1

-

6. PROJECT PLANING &PLANNING:

6.1 Sprint Planning & Estimation:

SPRINT	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint1	Registration (Customer)	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Ishaarrthy.B
Sprint1	Login	USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Karthiga M
Sprint1	Dashboard	USN-4	I am a new user, ready to explore the site via dashboard	2	High	Snegha S Preethi K
Sprint1	Registration (Administrator)	USN-1	I am in seek of my profile details and my exploring stuffs	2	High	Snegha S Preethi K
Sprint2	Login	USN-3	As an existing user, I can access the website with login credentials that are specific to myself.	1	Low	Ishaarrthy.B

Sprint2	Dashboard	USN-5	I am an existing user, pick from where I left	1	High	Karthiga M Snegha S
Sprint3	Image Uploading	USN-1	I am in need of suggestions of fertilizer for the crops in my field. So I am uploading the images for the same.	1	High	Perrthi K
Sprint3	Image Uploading	USN-2	I am in need of suggestions of my land (soil) but I don't have a clear picture of it. So I am specifying through text format.	2	High	Ishaarrthy B karthigaM
Sprint-4	View of recommends	USN-1	I am just an explorer, view of recommends are adequate	2	Low	Ishaarrthy B karthigaM
Sprint-4	Feedback Providing	USN-1	I finished of my journey on the website, time to provide feedback.	1	Low	Snegha S Ishaarrthy B
Sprint -4	Feedback Collection	USN-2	I need to see all other peer members' review about this site.	2	Low	Karthiga M Snegha S

6.2 Sprint Delivery Schedule:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	7 Days	24 Oct 2022	30 Oct 2022	20	30 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 Reports from JIRA:
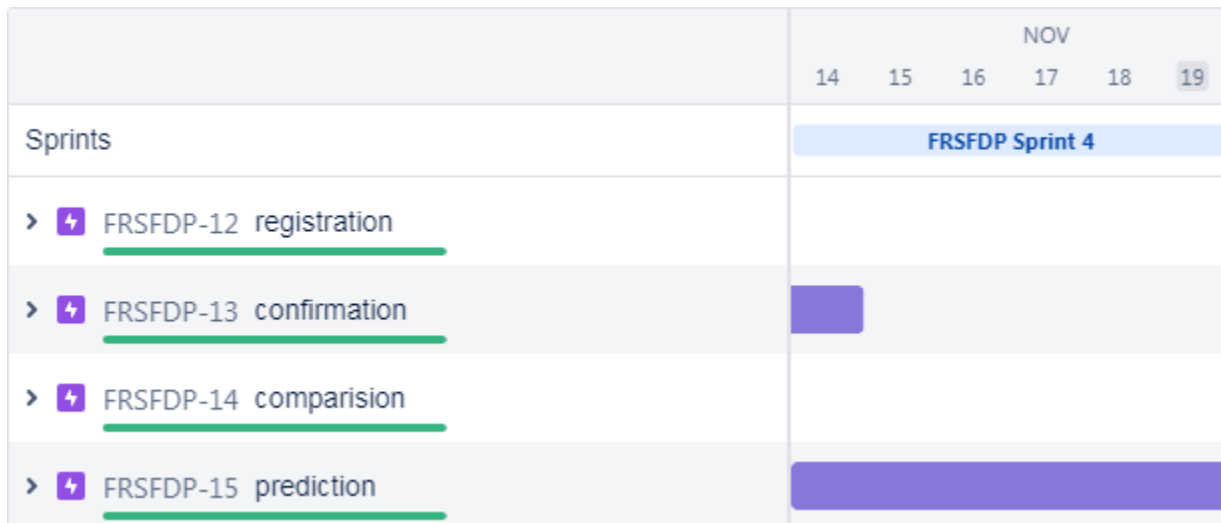
7. CODING & SOLUTIONING (Explain the features added in the project along with code):

7.1 Feature 1:
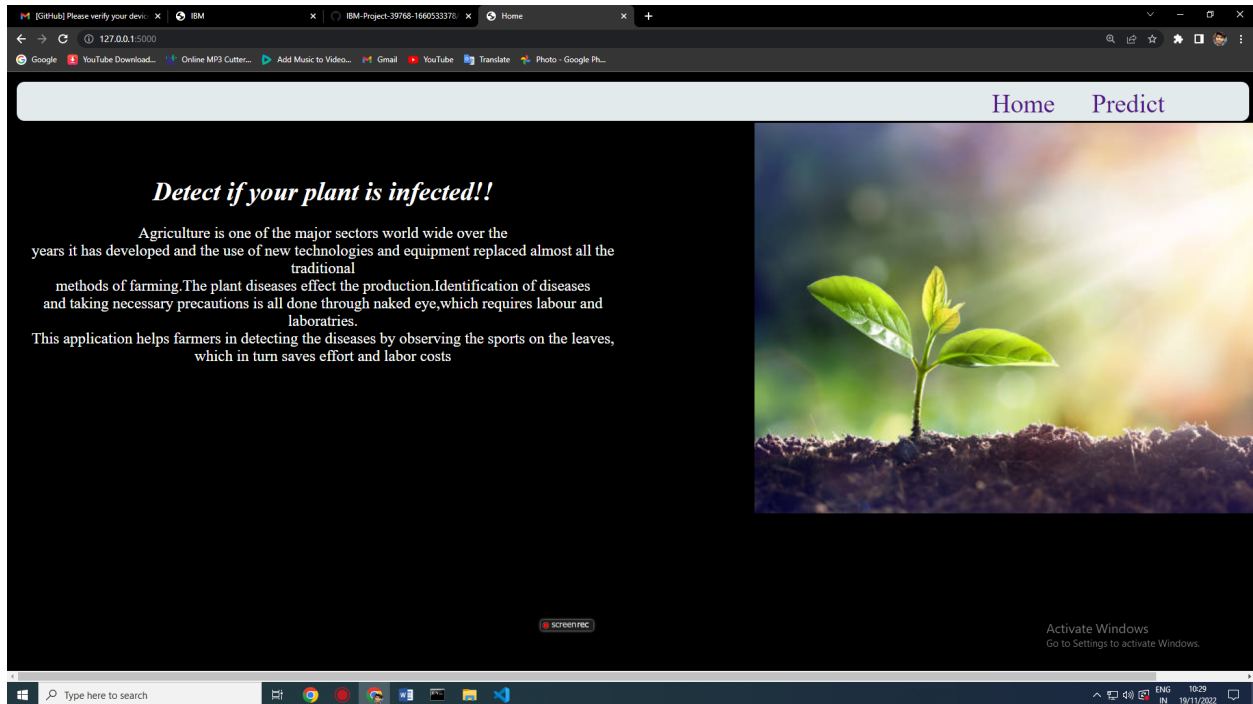
7.1 FEATURE2:
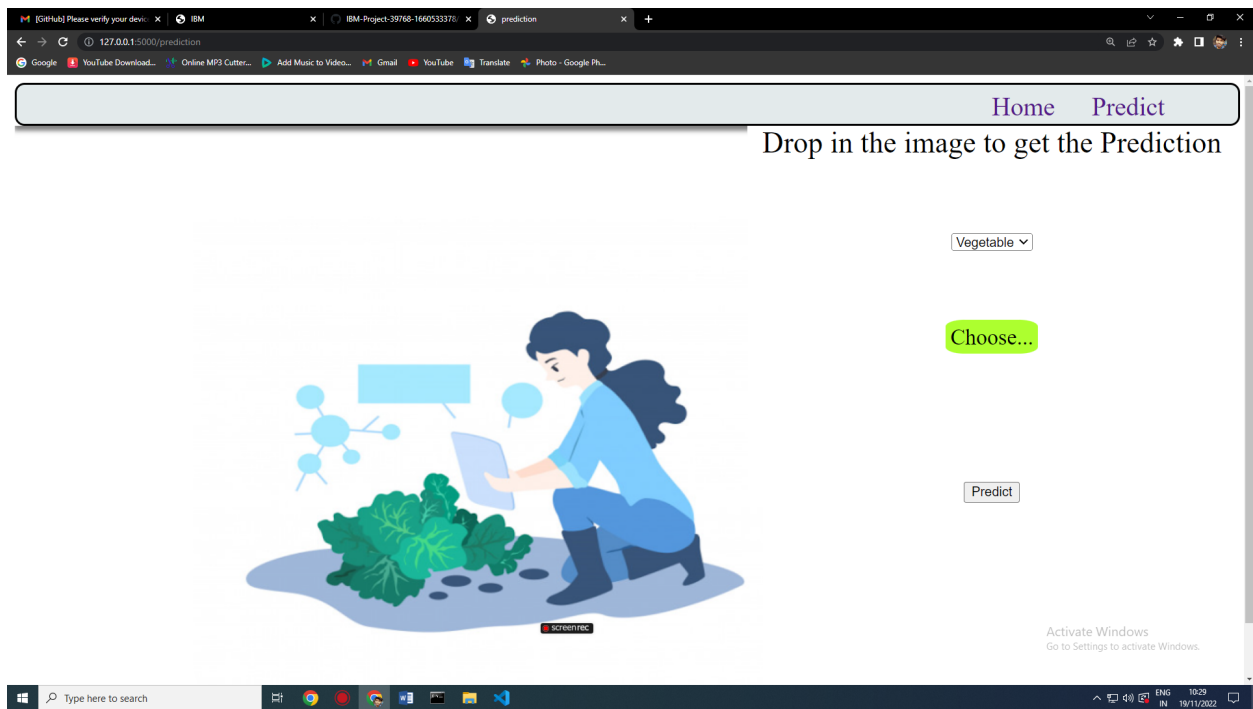
Database Schema:

8. TESTING:

8.1 Test Cases:

This report shows the numberof test cases that have passed, failed,and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	1	3	7
Client Application	51	3	2	51
Security	2	4	1	2
Outsource Shipping	3	1	1	3
Exception Reporting	9	3	2	9
Final ReportOutput	4	2	3	4
Version Control	2	1	1	2

8.2 User Acceptance Testing:

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	1	0	5
Fixed	9	2	4	20	37
Not Reproduced	2	0	1	0	1
Skipped	3	1	0	1	3
Won't Fix	0	0	2	1	5
Totals	27	10	13	26	75

9. RESULTS:

9.1 Performance Metrics:

VEGETABLE

```
Model: "sequential_2"
_____
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d_1 (Conv2D)           (None, 126, 126, 32)      896

 max_pooling2d_1 (MaxPooling  (None, 63, 63, 32)       0
 2D)

 flatten_1 (Flatten)         (None, 127008)            0

 dense_7 (Dense)             (None, 300)               38102700

 dense_8 (Dense)             (None, 150)               45150

 dense_9 (Dense)             (None, 75)                11325

 dense_10 (Dense)            (None, 9)                 684

=================================================================
Total params: 38,160,755
Trainable params: 38,160,755
Non-trainable params: 0
_____
```

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	1	0	5
Fixed	9	2	4	20	37
Not Reproduced	2	0	1	0	1
Skipped	3	1	0	1	3
Won't Fix	0	0	2	1	5
Totals	27	10	13	26	75

10. ADVANTAGES&DISADVANTAGES:

Advantages:

- They are quick in providing plant nutrients and restoring soil fertility. They are portable and easy to transport. Plants easily absorb fertilizers. Fertilizers improve and increase the productivity of many crops such as wheat, maize, and rice.

- Without fertilizers, nature struggles to replenish the nutrients in the soil. When crops are harvested, important nutrients are removed from the soil, because they follow the crop and end up at the dinner table. If the soil is not replenished with nutrients through fertilizing, crop yields will deteriorate over time.

- When the fertilizer is placed, there is minimum contact between the soil and the fertilizer, and thus fixation of nutrients is greatly reduced

- The weeds all over the field cannot make use of the fertilizers

Disadvantages:

- If fertilizer is used more or less in the field the soil may lose it fertility and crop may not give the expected yield. So, fertilizer also becomes the major factor in it. They get washed away by water easily and cause pollution.

- They harm the microbes present in soil. They reduce soil fertility.
- They are expensive. They provide only short term benefits.
- They change the nature of soil, making it either too acidic or too alkaline.

- Synthetic fertilizers typically only supply nitrogen, phosphorous, and potassium, but do not supply other nutrients to the soil. Consequently, the soil that is used for growing crops given synthetic fertilizers is depleted over time, and the food crops themselves become nutritionally deficient.

11. CONCLUSION:

The proposed method uses SVM to classify tree leaves, identify the disease and suggest the fertilizer. The proposed method is compared with the existing CNN based leaf disease prediction. The proposed SVM technique gives a better result when compared to existing CNN. For the same set of images, F-Measure for CNN is 0.7and 0.8 for SVM, the accuracy of identification of leaf disease of CNN is 0.6 and SVM is 0.8.

12. FUTURE SCOPE:

This further research is implementing the proposed algorithm with the existing public datasets. Also, various segmentation algorithms can be implemented to improve accuracy. The proposed algorithm can be modified further to identify the disease that affects the various plant organs such as stems and fruits

13. APPENDIX:

13.1. Source code:

INDEX

```html
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Home</title>
    <style>
        span{
            background-color:ivory;
            color: black;
            text-decoration-line: none;
        }
        #label{
            height: 40px;
            width: 100%;
            border: 2px solid;
            border-radius: 10px;
            background-color: rgb(227, 234, 235);
        }
```

```css
#label2{
    padding-top: .2cm;
    /*padding-right: ;*/ padding-bottom: .5cm;
    padding-left: 1000px;
    font-size: .7cm;
}
span{
    padding-right: 1cm;
    background-color: transparent;
}
body {
    background-color: black;
}
a{
    text-decoration: none;
}
p{
    color: white;
}
h1{
    color: aliceblue; font-size: 1cm;
    padding-top: 1cm; font-size: .7cm;
    text-align: center; color: white;
    font-style: italic;
}
#body{
    text-align: center;
    width: 50%;
    float: left;

}
#body2{
    width: 40%;
    float: right;
}
```

```html
    </style>
</head>
<body>
    <div id="label"> <div id="label2"><span><a
href="/">Home</a></span><span><a href="/prediction">Predict</a>
</span></div></div>
    <div id="body" >
```

```
        <h1>Detect if your plant is infected!!</h1>
    <p>Agriculture is one of the major sectors world wide over the<br>
        years it has developed and the use of new technologies and
equipment replaced almost all the traditional <br>
    methods of farming.The plant diseases effect the
production.Identification of diseases<br>
 and taking necessary precautions is all done through naked eye,which
requires labour and laboratries.<br>
 This application helps farmers in detecting the diseases by observing the
sports on the leaves,<br>
 which in turn saves effort and labor costs</style></p></div>
 <div id="body2">
    <img src="{{url_for('static', filename='plant.jpg')}}" alt="">
 </div>
</body>
</html>
```

PREDICT

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>prediction</title>
    <style>
        span{
            background-color:ivory;
            color: black;
            text-decoration-line: none;
        }
        h2{
            color: red;
            font-size: 1cm;
        }
        #label{
            height: 40px;
            width: 100%;
            border: 2px solid;
            border-radius: 10px;
            background-color: rgb(227, 234, 235);
```

```css
}
#label2{
    padding-top: .2cm;
    /*padding-right: ;*/ padding-bottom: .5cm;
    padding-left: 1000px;
    font-size: .7cm;
}
span{
    padding-right: 1cm;
    background-color: transparent;
}
a{
    text-decoration: none;
}
p{
    color: white;
}
h1{
    color: aliceblue;
    font-size: 1cm;
    padding-top: 1cm;
     font-size: .7cm;
    text-align: center;
     color: white;
    font-style: italic;
}
#body1{
    background-color: white;
    width: auto;
    height: auto;
    float: left;
}
#body2{
    height: 100%;
    background-color: white;
    width: 40%;
    height: auto;
    float: right;
    text-align: center;
}

#l2,#img{
    border-radius: 20%;
```

```
            padding: 1%;
            margin-top: 2cm;
            background-color: greenyellow;
            color: black;
            font-size: .6cm;
        }
        #select{
            margin-top: 2cm;
            margin-bottom: 2cm;
        }
        form{
            padding: auto;
        }

        #l1{
            margin-top: 12cm;
            color: black;
            font-size: .8cm;
        }
        input{
            margin-top: 10%;
        }
    </style>
</head>
<body>
    <div id="label"> <div id="label2"><span><a
href="/">Home</a></span><span><a href="/prediction">Predict</a>
</span></div></div>

    <div id="body1"><img src="{{url_for('static',
filename='prediction.png')}}" alt=""></div>
    <div id="body2" >
        <form action="/predict" method="post" enctype="multipart/form-
data">
            <label id="l1">Drop in the image to get the
Prediction</label><br>

            <select name="select" id="select" aria-
placeholder="select"><br>
                <option value="veg">Vegetable</option>
                <option value="frt">Fruit</option>
            </select><br>
```

```html
            <label id="l2" for="file">Choose...</label>
                <input type="file" name="file" id="file" hidden><br>
                <br>
                <h2>{{ data }}</h2>
            <br>
        <img src="data:image/png;base64,{{show}}" id="imgpic" alt=""
srcset=""{{h}}>
                <br><input type="submit" value="Predict">
        </form>
    </div>
</body>
</html>
```

APP.PY

```python
from keras.models import load_model
from flask import Flask,render_template,request
import os
from werkzeug.utils import secure_filename
import tensorflow as tf
from keras.utils import load_img,img_to_array
import pandas as pd
import numpy as np
import base64


app = Flask(__name__)


m = load_model('Fruits.h5')


def show(img):
    img = img
    data = base64.b64encode(img.getbuffer()).decode()
    return data

@app.route('/')
def home():
    return render_template('index.html')



@app.route('/prediction')
def prediction():
    h = 'hidden'
```

```python
        return render_template('predict.html',h=h)

@app.route('/predict',methods = ['GET','POST'])
def predict():
    if request.method == 'POST':
        f = request.files['file']
        pic = show(f)
        basepath=os.path.dirname(__file__)

file_path=os.path.join(basepath,'uploads',secure_filename(f.filename))
        f.save(file_path)
        print(f)
        img=load_img(file_path,target_size=(128,128))
        x=img_to_array(img)
        x=np.expand_dims(x,axis=0)
        plant=request.form['select']
        print(plant)
        if(plant=="veg"):
            preds=(model.predict(x) > 0.5).astype("int32")
            print(preds)
            preds = preds[0]
            preds = np.where(preds == 1)
            df=pd.read_excel('precautions-veg.xlsx')
            data = df.iloc[preds]
            print(data)
            return render_template('predict.html',data = data,show = pic)
        else:
            preds=(m.predict(x) > 0.5).astype("int32")
            preds = preds[0]
            preds = np.where(preds == 1)
            df=pd.read_excel('precautions-fruits.xlsx')
            data = df.iloc[preds]
            print(data)
            return render_template('predict.html',data = data,show = pic)




if __name__=='__main__':
    app.run()
```

13.2 GitHub & Project Demo Link

https://github.com/IBM-EPBL/IBM-Project-39784-1660535525/blob/main/Final%20Deliverables/Project%20Demo.mp4